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Approved for use through 09/30/00. OMB 0651-0032

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**UTILITY PATENT APPLICATION TRANSMITTAL**

(Only for new nonprovisional applications under 37 CFR 1.53(b))

Attorney Docket No. 042390.P9705 Total Pages 23First Named Inventor or Application Identifier Hong W. WongExpress Mail Label No. EL627467067US1c882 U.S. PTO  
09/29/00

09/29/00

**ADDRESS TO:** Commissioner of Patents & Trademarks  
 Box Patent Application  
 Washington, D. C. 20231

**APPLICATION ELEMENTS**

See MPEP chapter 600 concerning utility patent application contents.

1. X Fee Transmittal Form  
(Submit an original, and a duplicate for fee processing)
2. X Specification (Total Pages 23)  
(preferred arrangement set forth below)
  - Descriptive Title of the Invention
  - Cross References to Related Applications
  - Statement Regarding Fed sponsored R & D
  - Reference to Microfiche Appendix
  - Background of the Invention
  - Brief Summary of the Invention
  - Brief Description of the Drawings (if filed)
  - Detailed Description
  - Claims
  - Abstract of the Disclosure
3. X Drawings(s) 9 (35 USC 113) (Total Sheets 4)
4. X Oath or Declaration (Total Pages 6) unsigned
  - a.      Newly Executed (Original)
  - b.      Copy from a Prior Application (37 CFR 1.63(d))  
(for Continuation/Divisional with Box 17 completed) (**Note Box 5 below**)
  - i.      DELETIONS OF INVENTOR(S) Signed statement attached deleting inventor(s) named in the prior application, see 37 CFR 1.63(d)(2) and 1.33(b).
5.      Incorporation By Reference (useable if Box 4b is checked)  
The entire disclosure of the prior application, from which a copy of the oath or declaration is supplied under Box 4b, is considered as being part of the disclosure of the accompanying application and is hereby incorporated by reference therein.

1c930 U.S. PTO  
09/29/00

09/29/00

6. \_\_\_\_\_ **Microfiche Computer Program (Appendix)**

7. \_\_\_\_\_ **Nucleotide and/or Amino Acid Sequence Submission**  
(if applicable, all necessary)

- a. \_\_\_\_\_ **Computer Readable Copy**  
b. \_\_\_\_\_ **Paper Copy (identical to computer copy)**  
c. \_\_\_\_\_ **Statement verifying identity of above copies**

**ACCOMPANYING APPLICATION PARTS**

8. \_\_\_\_\_ **Assignment Papers (cover sheet & documents(s))**  
9. \_\_\_\_\_ a. **37 CFR 3.73(b) Statement (where there is an assignee)**  
\_\_\_\_\_ b. **Power of Attorney**  
10. \_\_\_\_\_ **English Translation Document (if applicable)**  
11. \_\_\_\_\_ a. **Information Disclosure Statement (IDS)/PTO-1449**  
\_\_\_\_\_ b. **Copies of IDS Citations**  
12. \_\_\_\_\_ **Preliminary Amendment**  
13. **XX** **Return Receipt Postcard (MPEP 503) (Should be specifically itemized)**  
14. \_\_\_\_\_ a. **Small Entity Statement(s)**  
\_\_\_\_\_ b. **Statement filed in prior application, Status still proper and desired**  
15. \_\_\_\_\_ **Certified Copy of Priority Document(s) (if foreign priority is claimed)**  
16. \_\_\_\_\_ **Other:** \_\_\_\_\_  
\_\_\_\_\_  
\_\_\_\_\_  
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17. **If a CONTINUING APPLICATION**, check appropriate box and supply the requisite information:

\_\_\_\_\_ **Continuation**      \_\_\_\_\_ **Divisional**      \_\_\_\_\_ **Continuation-in-part (CIP)**  
of prior application No: \_\_\_\_\_

18. **Correspondence Address**

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(Insert Customer No. or Attach Bar Code Label here)

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12/01/97

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PTO/SB/05 (12/97)

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**FEE TRANSMITTAL FOR FY 2000****TOTAL AMOUNT OF PAYMENT (\$) 762.00****Complete if Known:**Application No. UnknownFiling Date HerewithFirst Named Inventor: Hong W. WongGroup Art Unit UnknownExaminer Name UnknownAttorney Docket No. 042390.P9705**METHOD OF PAYMENT (check one)**

1. ☒ [ X ] The Commissioner is hereby authorized to charge indicated fees and credit any over payments to:

Deposit Account Number 02-2666Deposit Account Name BLAKELY, SOKOLOFF, TAYLOR & ZAFMAN, LLP☐ [ X ] Charge Any Additional Fee Required Under 37 CFR 1.16 and 1.17

2. ☒ X Payment Enclosed:

☒ X Check  
☐ Money Order  
☐ Other

**FEE CALCULATION****1. BASIC FILING FEE**

Large Entity		Small Entity		Fee Description	Fee Paid
Code	Fee (\$)	Code	Fee (\$)		
101	690	201	345	Utility application filing fee	<u>690.00</u>
106	310	206	155	Design application filing fee	<u>          </u>
107	480	207	240	Plant filing fee	<u>          </u>
108	690	208	345	Reissue filing fee	<u>          </u>
114	150	214	75	Provisional application filing fee	<u>          </u>
SUBTOTAL (1)					<u>\$690.00</u>

**2. EXTRA CLAIM FEES**

				Extra Claims	Fee from below	Fee Paid
Total Claims	24	- 20** =	4	X	18.00	= 72.00
Independent Claims	3	- 3** =	0	X	78.00	= 00
Multiple Dependent						=

\*\*Or number previously paid, if greater; For Reissues, see below.

Large Entity		Small Entity		Fee Description	Fee Paid
Code	Fee (\$)	Code	Fee (\$)		
103	18	203	9	Claims in excess of 20	
102	78	202	39	Independent claims in excess of 3	
104	260	204	130	Multiple dependent claim, if not paid	
109	78	209	39	**Reissue independent claims over original patent	
110	18	210	9	**Reissue claims in excess of 20 and over original patent	
SUBTOTAL (2)					<u>\$ 762.00</u>

01/10/2000

- 1 -

PTO/SB/17 (6/99)

Patent fees are subject to annual revisions. Small Entity payments must be supported by a small entity statement, otherwise large entity fees must be paid.

See Forms PTO/SB/09-12

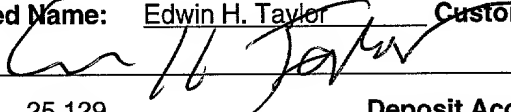
**FEE CALCULATION (continued)****3. ADDITIONAL FEES**

<u>Large Entity</u>		<u>Small Entity</u>		<u>Fee Description</u>	<u>Fee Paid</u>
<u>Fee Code</u>	<u>Fee (\$)</u>	<u>Fee Code</u>	<u>Fee (\$)</u>		
105	130	205	65	Surcharge - late filing fee or oath	_____
127	50	227	25	Surcharge - late provisional filing fee or cover sheet	_____
139	130	139	130	Non-English specification	_____
147	2,520	147	2,520	For filing a request for reexamination	_____
112	920*	112	920*	Requesting publication of SIR prior to Examiner action	_____
113	1,840*	113	1,840*	Requesting publication of SIR after Examiner action	_____
115	110	215	55	Extension for response within first month	_____
116	380	216	190	Extension for response within second month	_____
117	870	217	435	Extension for response within third month	_____
118	1,360	218	680	Extension for response within fourth month	_____
128	1,850	228	925	Extension for response within fifth month	_____
119	300	219	150	Notice of Appeal	_____
120	300	220	150	Filing a brief in support of an appeal	_____
121	260	221	130	Request for oral hearing	_____
138	1,510	138	1,510	Petition to institute a public use proceeding	_____
140	110	240	55	Petition to revive unavoidably abandoned application	_____
141	1,210	241	605	Petition to revive unintentionally abandoned application	_____
142	1,210	242	605	Utility issue fee (or reissue)	_____
143	430	243	215	Design issue fee	_____
144	580	244	290	Plant issue fee	_____
122	130	122	130	Petitions to the Commissioner	_____
123	50	123	50	Petitions related to provisional applications	_____
126	240	126	240	Submission of Information Disclosure Stmt	_____
581	40	581	40	Recording each patent assignment per property (times number of properties)	_____
146	690	246	345	For filing a submission after final rejection (see 37 CFR 1.129(a))	_____
149	690	249	345	For each additional invention to be examined (see 37 CFR 1.129(a))	_____
Other fee (specify) _____					_____
Other fee (specify) _____					_____

**SUBTOTAL (3) \$ 762.00**

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**SUBMITTED BY:**

Typed or Printed Name: Edwin H. Taylor Customer Number: 008791  
Signature:  Date: September 29, 2000  
Reg. Number: 25,129 Deposit Account User ID: \_\_\_\_\_  
(complete if applicable)

UNITED STATES UTILITY PATENT APPLICATION

for

POWER MANAGEMENT STRATEGY TO SUPPORT  
HOT SWAPPING OF SYSTEM BLADES DURING RUN TIME

Inventor:

Hong W. Wong

Attorney Docket No.: 042390.P9705

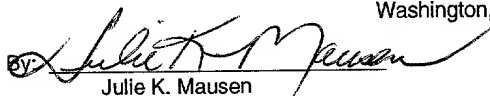
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Julie K. Mausen

Date Signed: September 29, 2000

POWER MANAGEMENT STRATEGY TO SUPPORT  
HOT SWAPPING OF SYSTEM BLADES DURING RUN TIME

BACKGROUND OF THE INVENTION

5           1. Field of the Invention.

The invention relates to the field of systems with hot swappable components.

          2. Prior Art and Related Art.

          In many applications it is necessary to have a system which remains  
10   in operation even when under repair. For instance, a server in a network  
may have boards or blades in a standby mode or with excess capacity.  
When a blade is detected as having failed, other blades that were in a stand-  
by mode take over while the failed blade is replaced. Alternatively, blades  
with excess capacity are used to pick-up the tasks of the failed blade while it  
15   is replaced. Generally, an alarm or other indication is given to an operator  
indicating that a failure has occurred. The operator is then able to remove  
the failed blade and reinsert a good blade. One of the major problems in  
these systems is the management of power as these changes occur.

          Often in such systems connectors are used having pins of different  
20   lengths which cooperatively engage sockets. For instance, a backplane in a  
server may have a plurality of connectors, each for receiving a blade where  
the pins in the connectors are of different lengths. These pins are used for

instance, to allow discharge of static electricity as well as other functions.

# BRIEF DESCRIPTION OF THE DRAWINGS

Figure 1 is a block diagram of a system built in accordance with the present invention.

Figure 2A is a flow diagram illustrating the events occurring during the  
5 normal insertion of a blade into the system of Figure 1.

Figure 2B is a flow diagram illustrating the events occurring during the normal extraction of a blade from the system of Figure 1.

Figure 3 is a flow diagram illustrating the events occurring during the forced extraction of a blade from the system of Figure 1.

10 Figure 4 is a flow diagram illustrating the events occurring during the failure process of a blade in the system of Figure 1.

Figure 5 is a diagram illustrating a backplane, a connector with pins of three different lengths and a blade which cooperatively engages the connector in accordance with the present invention.



## DETAILED DESCRIPTION OF THE PRESENT INVENTION

A system is described having a backplane bus and a plurality of blades or boards which may be extracted or inserted while the system is in operation. This is often referred to as "hot swapping."

5 In the following description, numerous specific details are set forth, such as specific voltages in order to provide a thorough understanding of the present invention. It will be apparent to one skilled in the art that the present invention may be practiced without these specific details. In other instances, well-known circuits and other components have not been set forth in detail in  
10 order not to obscure the present invention.

The present invention is described in connection with a server having hot swappable blades. Referring to Figure 1, the system includes a backplane bus only a portion of which is shown in Figure 1. Lines 13 and buses 30 are the only portion of the backplane shown, power and ground  
15 lines are not shown. The buses shown by the bracket 30 include the Interchassis Management Bus (IMB), Universal Serial Bus (USB), Keyboard/Video/Mouse (KVM) bus, I<sup>2</sup>C bus, RS232 port and a fan control bus. Other buses may be used. While the system management bus (SM Bus) is shown as part of the backplane in Figure 1, the SM Bus in one  
20 embodiment is a separate bus interconnecting the blades in the system.

In one embodiment, the server includes several different units which may be hot swapped and which engage the backplane bus. These include the two server management blades (MBs) shown in Figure 1 as blades 10 and 12. The server also includes at least one switch blade 14 and typically include 2 more switch blades. These switch blades provide network switching of packets and routing for various protocol layers such as layers 2, 3, 4 to 7. Additionally there are a plurality of central processing unit (CPU) blades, for instance, 38 CPU blades may be used or even a higher number. Two such blades 15 and 16 are shown in Figure 1. These blades perform the normal computing functions required of a server.

While not shown in Figure 1, the system also includes at least one power sharing board for distributing power (48V DC in one embodiment) to the various blades in the system from the backplane. Also, multiple fans are used for cooling which is often the case in such systems.

The present invention provides operating characteristics for the server which meet the predetermined criteria shown below in a table.

Hot Swap States	Blade Status				CPU Blade	Switch Blade	System Mgmt Blade
	Operation State	3V or 5V stby	Reset	48V DC Cvtr			
P0	The blade is physically separated from the system				Yes	Yes	Yes
P1/H0	The blade is fully seated	On	On	Off	Yes	Yes	Yes
H1	The blade is fully seated and powered up	On	On	On			
H2	The blade is allowed to boot up to BIOS/Embedded SW/Diagnostics partition	On	Off	On	Yes	Yes	Yes
H1F	The blade is allowed to boot up, but the board has detected an error and powered itself down. BIOS/embedded SW stopped running	On	Off	Off, over-ridden by blade	Yes	Yes	Yes
H3	The blade is powered up and is operating in its normal state, with OS or Embedded SW running	On	Off	On	Yes	Yes	Yes

In the table above the hot swap states include P0 which is the state where the board is removed from the backplane and P1, the states where a blade is fully inserted into the backplane. The state H0 through H3 indicate several operational states for the blade as indicated in the above table. The “Yes” in the last three columns of the table indicate that the CPU blade, switch blades and SMBs support the indicated hot swap states.

While the server operates primarily on 48V DC there is also a 3V or 5V standby power used for a sleep mode. The state of that power is shown under “5V stby” in the above table. The system also employs a reset signal which is discussed below and shown in the table. The power management

apparatus of the present invention, as will become apparent from the description below, provides the capability shown in the table.

Each of the blades includes a power supply which, in one embodiment, is a DC-to-DC converter for filtering and regulating the 48V power. The converter is enabled with an enable signal as will be discussed. The state of the converter is shown as either "off" or "on" in the above table.

One of the major problems in a hot swappable system is providing power to the blades and maintaining the power when the blades are hot swapped. The removal and insertion of blades often causes transients in the power delivery system which affect the operation of other blades and the power subsystem.

In one embodiment of the present invention each of the blades includes a female connector and a corresponding male connector in the backplane having pins of three different lengths. This is shown in Figure 5 where backplane 100 is shown along with a male connector 101. The male connector 101 has a plurality of pins only a few of which are shown in Figure 5. Each of the pins are one of three lengths, a first and longest length such as pin 106; the shortest length such as pin 102; and, a medium length pin which is longer than the shortest length pin and shorter than the longest length pin such as pin 103. The corresponding female socket in each of the

blades such as blade 108 of Figure 5 includes a plurality of sockets each of which cooperatively engages its respective pin.

While typically the male connector is part of the backplane and the female connector is on the blade, in another embodiment the male connector may be on the blade and the female connector in the backplane. In this patent "pin/socket" is sometimes used to indicate that either the pin or the socket is being designated, depending on whether the backplane has the male or female connector. The term pin/socket indicates, for instance, that the socket cooperatively receives a pin of a designated length.

As is apparent from Figure 5, as the blade 108 is inserted, electrical contact will first be made between the longest pins such as pin 106 and corresponding sockets such as socket 121. As insertion continues, the medium length pins next make contact such as the pin 103. And finally, as insertion continues the shortest pins such as pins 102 and 105 make contact with sockets 120 and 125, respectively. Likewise on extraction, first the shortest pins/sockets part, followed by the medium pins/sockets, and finally the longest pins/sockets separate.

Each of the blades includes a power supply which in one embodiment is a 48V DC-to-DC converter. As shown in Figure 5 the converter 109 has an input terminal which receives input power for the blade from lines in the backplane 110. Each of the converters has an output terminal 111 which

provides regulated DC power for the blade. The converters also has an enable terminal 112 that controls an enable function in the converter. This turns the converter “on” or “off”. When turned off, that is when disabled, the input terminal 110 is effectively decoupled from the output terminal 111.

- 5 This decouples the substantial capacitance typically found at the output of a converter from terminal 110.

The input terminal to the converter receives power from two different lines. A first line 114 is connected to the shortest length of the three pin/socket lengths (pin 115 and socket 122). The input terminal 110 also  
 10 receives power from a long pin/socket namely pin 106 and socket 121. This pin/socket is connected to the input terminal 110 through a resistor 116. This resistor as will be discussed, plays an important role in dampening transient currents to the blade. The ground connection to the blade is through a long pin/socket.

- 15 The data signals are connected to the medium pins/sockets such as through pin 103.

Referring again to Figure 1, there are several signals used for the power management which are specifically shown in Figure 1. Lines 27 provide signals from the CPU blade 15 and the switch blade 14 to the blade  
 20 microcontrollers 20 of the MBs 10 and 12. These signals include a “presence signal” which indicates the presence of the board. Thus, when a

board is seated in the backplane, the microcontrollers on the MBs can detect the presence of each of the boards individually. Another signal is the “power good” signal. This signal indicates that a blade once installed, has the proper power. This is detected at the output of the DC-to-DC converter.

- 5 Another signal is a signal to indicate the health or failure of a board. Internal circuitry on the board, for instance self-test circuitry, can indicate when a blade has failed and provide a signal to the MBs indicating such failure.

The lines 26 which are the system management (SM) bus provide control signals from the MBs 10 and 12 to the other blades in the system.

- 10 Among the signals provided as shown at the blade 15 are a reset signal, a converter enable signal shown as “DC-DC on” and the non-maskable interrupt (NMI) signal. All of the signals discussed in connection with lines 26 and 27 may be encoded onto a serial bus such as the I<sup>2</sup>C bus for distribution to the blades.

- 15 In one embodiment there are two server MBs 10 and 12. One of these two blades is active and the other is in stand-by. Lines 25 in one embodiment comprising a separate bus interconnecting the MBs 10 and 12. This bus provides a signal between the MBs indicating the health of the MBs. For instance, the inactive MB may periodically ping the active MB to
  - 20 determine its health. If the inactive blade determines that the active MB has failed it can power up and take over the system management. To this end, a

multiplexer (e.g., MUX22) is used at the output of each of the MBs to allow the selection of appropriate SM bus signals. EEPROMs on the MBs (such as EEPROM 21) allow each MB to be prepared to take over at anytime since each stores the data needed for continued operation of the system.

5           Thus, while one of the MBs handles the housekeeping chores, the other one acts as a hot spare. The peer-to-peer heartbeat monitor (or similar implementation) as mentioned is used for one blade to monitor the status of the other blade. If the active management blade fails to respond to the heartbeat "pinging," that blade is considered to fail and the hot spare  
10   blade takes over. A failure LED on the face plate of the failed management blade turns on and an alert is sent out by the hot spare to warn a system administrator of the failure event.

Referring now to Figure 2A, the operation of a system is illustrated for the normal insertion of a blade. At P0 indicated by 40, the blade is  
15   separated from the backplane. At 51 (P1/H0) the blade is fully inserted into the backplane and at this time the blade provides an indication to the server MB 52 indicating its presence. This may be, for instance, the closing of a loop through the inserted blade or a signal provided by the 5V power supply. When the system MB 52 senses the presence of the blade it enables the  
20   power supply as shown by line 52. This is the signal which is connected to the terminal 112 of the DC converter as shown in Figure 5. Once the power



supply is activated, a “power good” signal may be provided to MB 54 as indicated by line 53. A “power good” signal can be provided by a power sensing chip on the blade, as an example. Thus, at H1 indicated by 55 the board is fully seated and its power is on.

5        Now the MB 54 deasserts the reset signal allowing the newly inserted blade to boot up. This is indicated by the line 57. At H2 indicated by 58, the inserted blade indicates that it is on and healthy by the health bit over the backplane or over a separate SM bus. At H3 indicated by 59, normal operation of the inserted blade occurs with the blade operating system or  
10    embedded software up and running.

Figure 2B indicates a normal extraction. For normal extraction, an operator initiates a shut-down process in the operating system or a similar command in the embedded software. An alert-on-LAN message to the MB 54 occurs. The blade that will be extracted then goes through a normal shut-  
15    down and places itself into a soft-off state. This indicated in Figure 2B by the transition from H3 (60) to H2 (61) then to H1 (62). At this point in time, the blade to be extracted deasserts the health bit as indicated by line 63. Now MB 54 asserts reset and then disables the converter as indicated by line 67. Typically, an LED on the front panel of the blade to be extracted illuminates  
20    indicating to the operator that the blade may now safely be removed. This is indicated by the transition from H1/H0 (70) to P0 (71).

The normal insertion and extraction is obviously the easier case to deal with from the standpoint of power management and power transients. Figure 3 illustrates the more difficult case of a forced extraction. This case assumes that the board is extracted without first informing the MB 54 of

- 5 Figure 3. The transitions from 72 to 73 to 74 to 75 occur almost instantaneously. The MB 54 is able to detect this unplanned extraction of a blade, such as a CPU node, and perform the necessary remedial action.

- As shown by line 76, as the blade is extracted the short pins/sockets of the connector such as pin 102 and socket 120 of Figure 5, first disengage.
- 10 Among the short pins/sockets that first disengage is a pin carrying the enable signal to the power supply. When this path breaks the converter is shut-down and input terminal 110 of the converter is substantially disconnected from the output terminal 111. Thus the capacitance associated with the output of the converter is disconnected from the input
- 15 terminal. The 48V power supply to the input of the converter (which bypasses resistor 116) is also disengaged since it is connected to the converter on a short pin/socket.

- At this time the “power good” signal is deasserted and the health bit is deasserted as shown by line 76. As indicated by line 77, the MB 54
- 20 deasserts the enable signal for the converter. This is done to prevent a re-powering up of the blade if the blade were to be reinserted immediately. If

this were not done and the blade was immediately reinserted, the large capacitance associated with the output of the converter would be immediately coupled through the short pin providing the direct connection to the 48V power supply. This would cause an unwanted transient which may  
 5 affect other blades in the system.

Next as indicated at 80, the medium length pins/sockets break contact. These include the data signals associated with the CPU and switching blades. At 81 the long pins/sockets break contact. Among the long pins that break contact at this point is the 48V power supply which is  
 10 coupled to the input of the converter through the resistor 116 of Figure 5. Both on extraction and on reassertion this resistor dampens the transients associated with decoupling and decoupling the converter from the backplane. This is particularly important if, for example, for some reason the power supply remains enabled during immediate reassertion. If this were to  
 15 occur, the first power applied to the converter would be through the resistor 116 dampening the surge which occurs when the converter is abruptly activated. By the time the shortest pins/sockets make contact this transient will have diminished. As also indicated at 81 the stand-by power being on one of the longest pins/sockets also breaks contact.

20 Figure 4 illustrates the case where a failure occurs on boot up. As indicated at 80, the blade is inserted and its presence detected by the MB

54. 81 indicates the normal activation of the power supply. 82 indicates that the blade has good power and that at this point the insertion process is proceeding normally. After H1 (83) as indicated by 84, reset is deasserted and the blade is allowed to boot up. Assume shortly thereafter, as indicated at 84, failure occurs (H1F) the blade itself deactivates the power supply and informs the MB 54 of the failure. This is the response that would occur if for instance, an on-blade sensor detects an overheat condition. At this point the MB 54 asserts reset and disables the converter.

---

10            Thus, a power management system has been described for a system having hot swappable blades.

## CLAIMS

What is claimed is:

1. A hot swappable blade comprising:  
a connector having a first pin/socket and a second pin/socket, the first pin/socket being longer than the second pin/socket;  
the first and second pins/sockets being coupled to an input power terminal on the blade; and  
a resistor connected between the first pin/socket and the input power terminal.
2. The blade defined by claim 1 wherein the blade includes a power converter which receives power from the input power terminal and provides power to the blade from an output power terminal located on the blade.
3. The blade defined by claim 2 wherein the power converter has an enable function for substantially disconnecting and connecting the input terminal and output terminals of the converter as the converter is disabled and enabled, respectively.

4. The blade defined by claim 3 wherein the enable function is controlled by a signal received by the blade on a third pin/socket having approximately the same length as the second pin/socket.

5. The blade defined by claim 4 wherein the connector includes a plurality of fourth pins/sockets for receiving data, the fourth pins/sockets having a length intermediate between the first and second pins/sockets.

6. The blade defined by claim 1 wherein the connector includes a plurality of data pins/sockets for receiving data, the data pins/sockets having a length intermediate between the first and second pins/sockets.

7. A hot swappable blade comprising:  
 a connector having a plurality of pins/sockets including a first pin/socket of a first length, the first length being the shortest length of the pins/sockets in the plurality of pins/sockets; and  
 a power supply having an enable function which interrupts the flow of power from a power supply input terminal and a power supply output terminal when the power supply is disabled by a signal applied to an enable terminal, the enable terminal being coupled to the first pin/socket.

8. The blade defined by claim 7 including a second pin/socket equal in length to the first pin/socket and a third pin/socket having a second length, the second length being the longest length of the pins/sockets in the plurality of pins/sockets, the second and third pins/sockets being coupled to the input terminal of the power supply.

9. The blade defined by claim 8 including a resistor connected between the third pin packet and the input terminal of the power supply.

10. The blade defined by claim 9 wherein the power supply is a DC-to-DC converter.

11. The blade defined by claim 1 wherein the power supply is a DC-to-DC converter.

12. The blade defined by claim 10 including a plurality of data receiving pins/sockets having a length longer than the first length and shorter than the second length.

13. A system comprising:

a backplane bus;

a plurality of blades each having a connector to engage the backplane including two management blades (MBs) and a plurality of other blades (OBs);

each connector having first length of a first length, second pins/sockets of a second length and third pins/sockets of a third length; the first length being the longest length, the third pins/sockets being the shortest length and the second length being longer than the third length and shorter than the first length;

the backplane bus having power lines which cooperatively engages one of the first pins/sockets and one of the third pins/sockets on each of the blades.

14. The system defined by claim 13 wherein data is communicated among the blades over the backplane bus through the second pins/sockets on each of the blades.



15. The system defined by claim 13 wherein each of the blades includes a resistor connected to the one of the first pins/sockets that receives power from the power line.

16. The system defined by claim 15 wherein each of the OBs provides a signal indicating its presence in the backplane over one of the third pins/sockets.

17. The system defined by claim 16 wherein each of the OBs includes a DC-to-DC converter which is enabled by an enable signal received over one of the third pins/sockets from the backplane bus.

18. The system defined by claim 17 wherein the enable signals for the OBs originates from one of the MBs.

19. The system defined by claim 17 wherein each of the OBs provides a signal to at least one of the MBs indicating the status of its DC power.

20. The system defined by claim 13 wherein the system is a server.
21. The system defined by claim 19 wherein the system is a server.
22. The system defined by claim 21 including an additional bus connecting to the MBs.
23. The system defined by claim 22 wherein signals indicating the health of the MBs is communicated over the additional bus.
24. The system defined by claim 23 wherein the OBs include a plurality of central processing unit blades and a plurality switch blades.

ABSTRACT OF THE DISCLOSURE

- A hot swappable system is described. It included software controlled hot swapping operations which provided a graceful booting or power-down of the system. In the even of force insertion or extraction of the system blades,
- 5 a set of hardware features (such as using different pin lengths in the connectors and dampening resistor) prevents these types of operations from damaging the system hardware or affecting the operation states of other blades within the system.

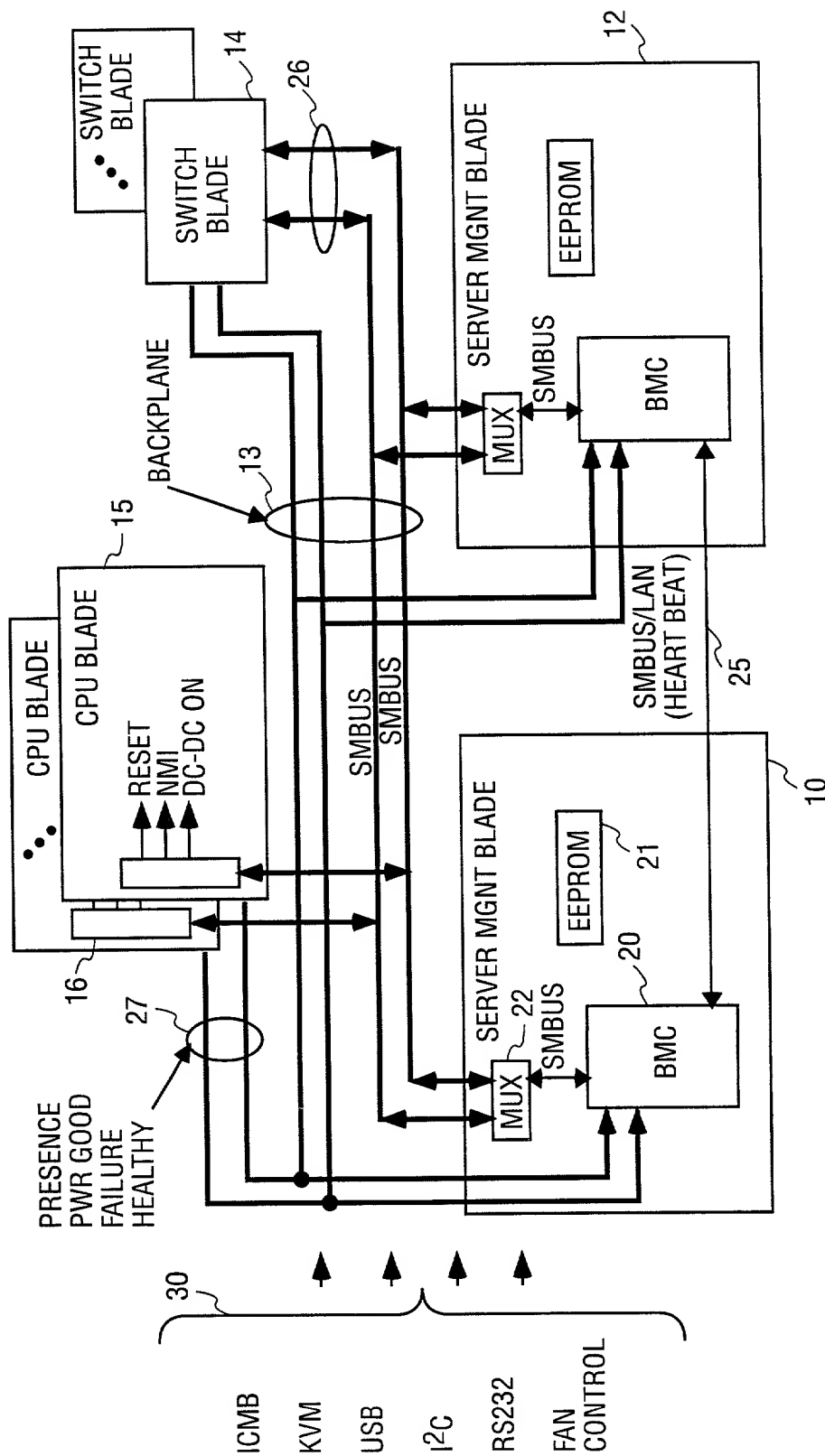
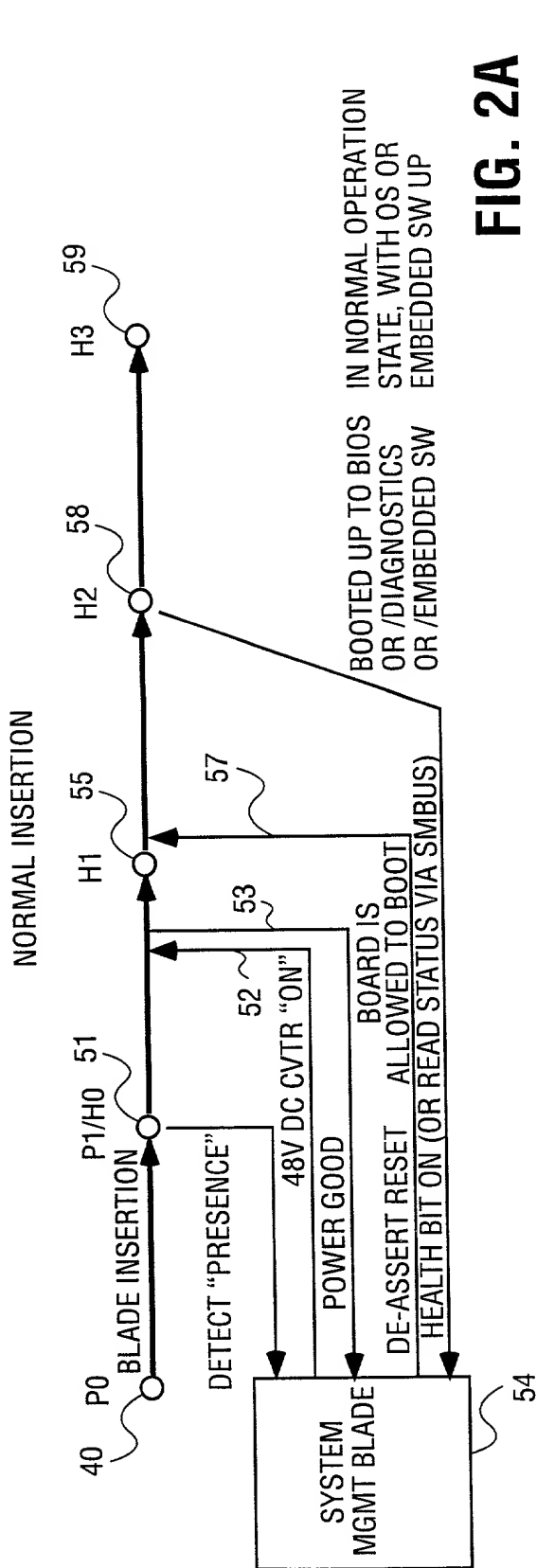
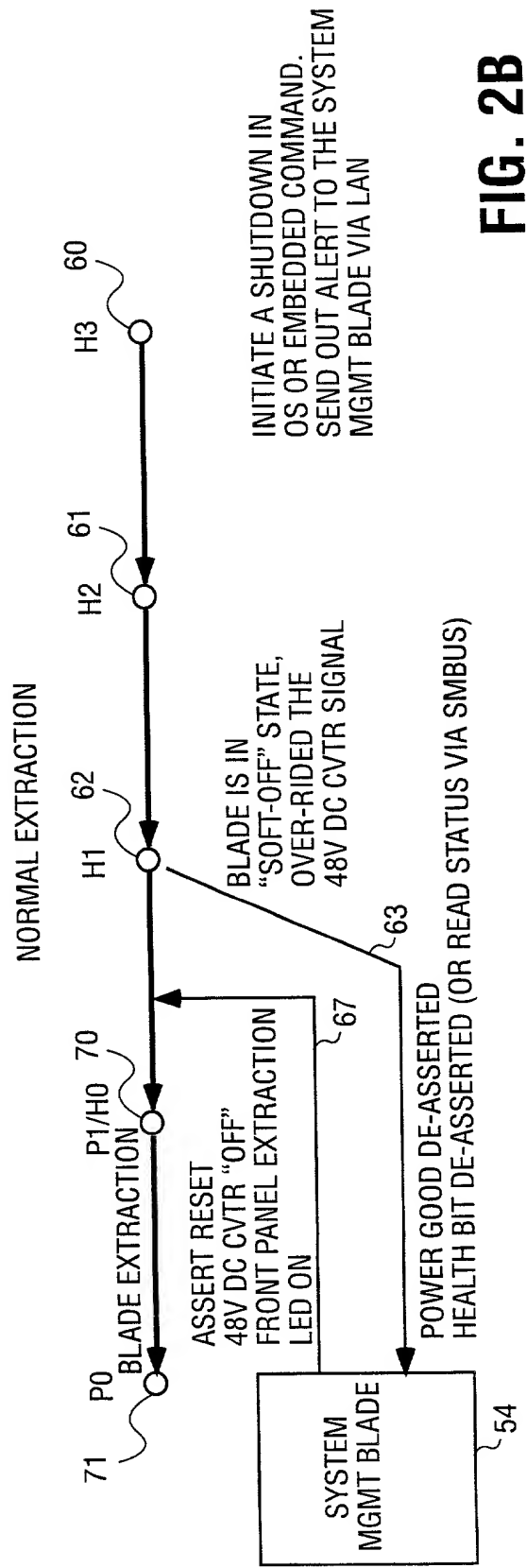


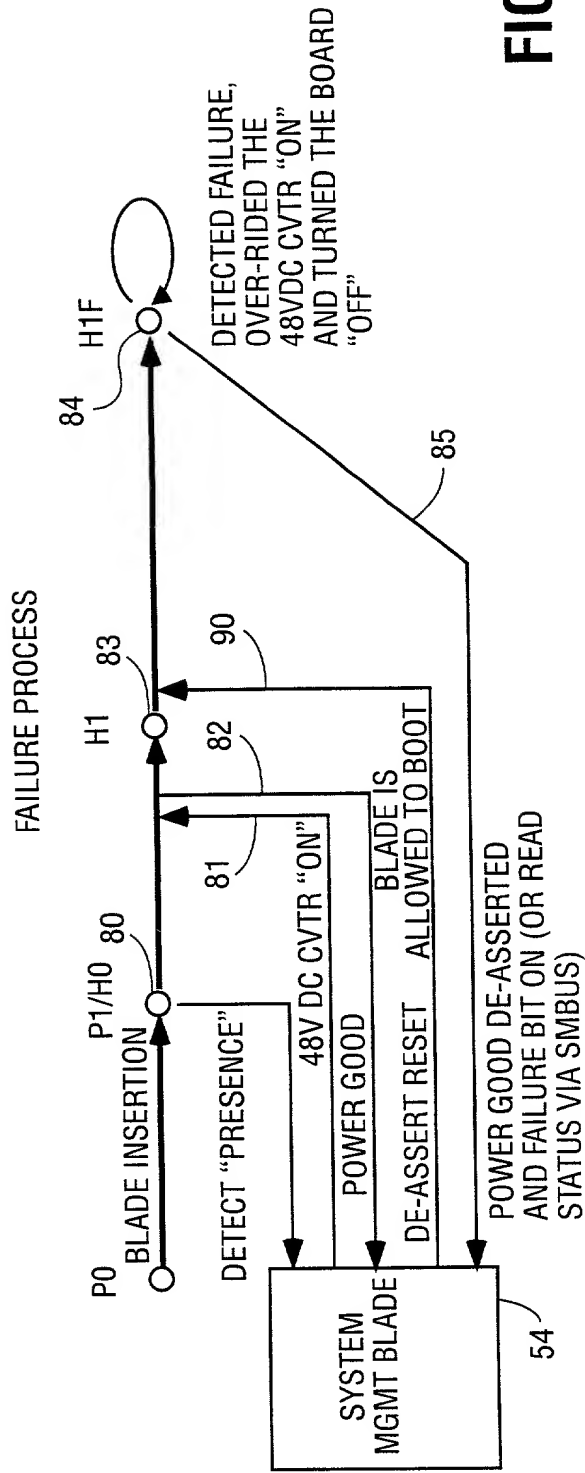
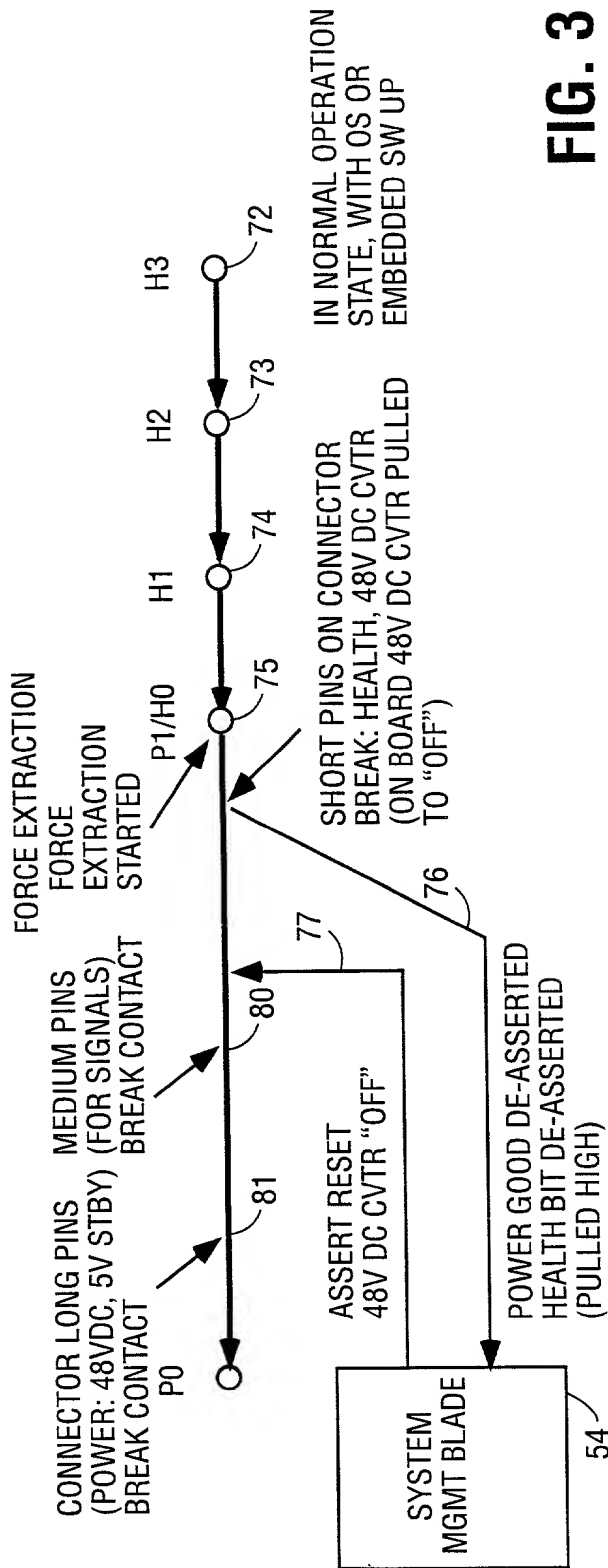
FIG. 1

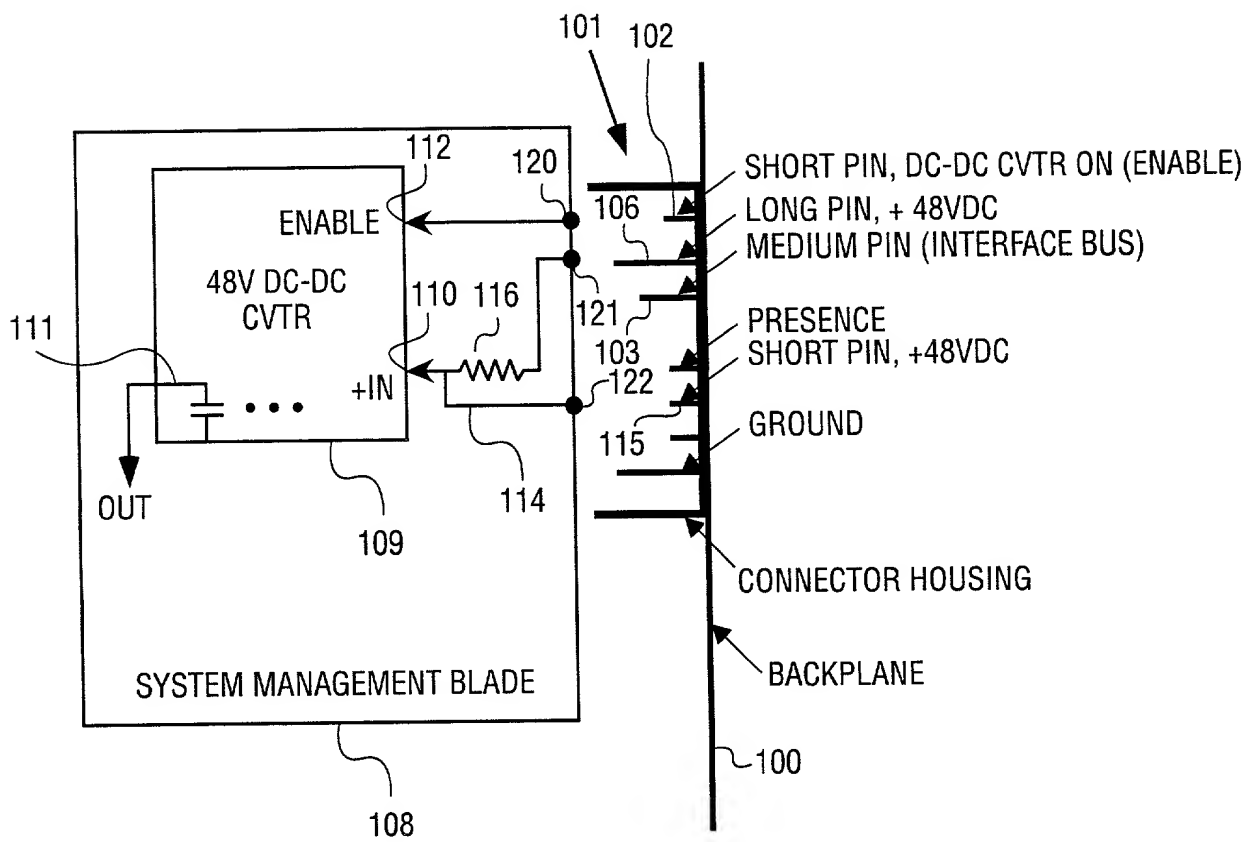


**FIG. 2A**



**FIG. 2B**





**FIG. 5**

**DECLARATION AND POWER OF ATTORNEY FOR PATENT APPLICATION**  
**(FOR INTEL CORPORATION PATENT APPLICATIONS)**

As a below named inventor, I hereby declare that:

My residence, post office address and citizenship are as stated below, next to my name.

I believe I am the original, first, and sole inventor (if only one name is listed below) or an original, first, and joint inventor (if plural names are listed below) of the subject matter which is claimed and for which a patent is sought on the invention entitled

**POWER MANAGEMENT STRATEGY TO SUPPORT  
HOT SWAPPING OF SYSTEM BLADES DURING RUN TIME**

the specification of which

XX is attached hereto.  
\_\_\_\_\_ was filed on (MM/DD/YYYY) \_\_\_\_\_ as  
United States Application Number \_\_\_\_\_  
or PCT International Application Number \_\_\_\_\_  
and was amended on (MM/DD/YYYY) \_\_\_\_\_.  
(if applicable)

I hereby state that I have reviewed and understand the contents of the above-identified specification, including the claim(s), as amended by any amendment referred to above. I do not know and do not believe that the claimed invention was ever known or used in the United States of America before my invention thereof, or patented or described in any printed publication in any country before my invention thereof or more than one year prior to this application, that the same was not in public use or on sale in the United States of America more than one year prior to this application, and that the invention has not been patented or made the subject of an inventor's certificate issued before the date of this application in any country foreign to the United States of America on an application filed by me or my legal representatives or assigns more than twelve months (for a utility patent application) or six months (for a design patent application) prior to this application.

I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56.

I hereby claim foreign priority benefits under Title 35, United States Code, Section 119(a)-(d), of any foreign application(s) for patent or inventor's certificate listed below and have also identified below any foreign application for patent or inventor's certificate having a filing date before that of the application on which priority is claimed:



Prior Foreign Application(s)

Priority  
Claimed

<u>(Number)</u>	<u>(Country)</u>	<u>(Foreign Filing Date - MM/DD/YYYY)</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Foreign Filing Date - MM/DD/YYYY)</u>	<u>Yes</u>	<u>No</u>
<u>(Number)</u>	<u>(Country)</u>	<u>(Foreign Filing Date - MM/DD/YYYY)</u>	<u>Yes</u>	<u>No</u>

I hereby claim the benefit under Title 35, United States Code, Section 119(e) of any United States provisional application(s) listed below:

<u>Application Number</u>	<u>(Filing Date – MM/DD/YYYY)</u>
<u>Application Number</u>	<u>(Filing Date – MM/DD/YYYY)</u>

I hereby claim the benefit under Title 35, United States Code, Section 120 of any United States application(s) listed below and, insofar as the subject matter of each of the claims of this application is not disclosed in the prior United States application in the manner provided by the first paragraph of Title 35, United States Code, Section 112, I acknowledge the duty to disclose all information known to me to be material to patentability as defined in Title 37, Code of Federal Regulations, Section 1.56 which became available between the filing date of the prior application and the national or PCT international filing date of this application:

<u>Application Number</u>	<u>(Filing Date – MM/DD/YYYY)</u>	<u>Status -- patented, pending, abandoned</u>
<u>Application Number</u>	<u>(Filing Date – MM/DD/YYYY)</u>	<u>Status -- patented, pending, abandoned</u>

I hereby appoint the persons listed on Appendix A hereto (which is incorporated by reference and a part of this document) as my respective patent attorneys and patent agents, with full power of substitution and revocation, to prosecute this application and to transact all business in the Patent and Trademark Office connected herewith.

Send correspondence to \_\_\_\_\_, BLAKELY, SOKOLOFF, TAYLOR &  
(Name of Attorney or Agent)  
ZAFMAN LLP, 12400 Wilshire Boulevard 7th Floor, Los Angeles, California 90025 and direct  
telephone calls to \_\_\_\_\_, (408) 720-8300.  
(Name of Attorney or Agent)

I hereby declare that all statements made herein of my own knowledge are true and that all statements made on information and belief are believed to be true; and further that these statements were made with the knowledge that willful false statements and the like so made are punishable by fine or imprisonment, or both, under Section 1001 of Title 18 of the United States Code and that such willful false statements may jeopardize the validity of the application or any patent issued thereon.

Full Name of Sole/First Inventor Hong W. Wong

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

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Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

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Full Name of Fourth/Joint Inventor \_\_\_\_\_

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

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Full Name of Fifth/Joint Inventor \_\_\_\_\_

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

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Full Name of Sixth/Joint Inventor \_\_\_\_\_

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

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Full Name of Seventh/Joint Inventor \_\_\_\_\_

Inventor's Signature \_\_\_\_\_ Date \_\_\_\_\_

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## APPENDIX A

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## APPENDIX B

### Title 37, Code of Federal Regulations, Section 1.56 Duty to Disclose Information Material to Patentability

(a) A patent by its very nature is affected with a public interest. The public interest is best served, and the most effective patent examination occurs when, at the time an application is being examined, the Office is aware of and evaluates the teachings of all information material to patentability. Each individual associated with the filing and prosecution of a patent application has a duty of candor and good faith in dealing with the Office, which includes a duty to disclose to the Office all information known to that individual to be material to patentability as defined in this section. The duty to disclosure information exists with respect to each pending claim until the claim is cancelled or withdrawn from consideration, or the application becomes abandoned. Information material to the patentability of a claim that is cancelled or withdrawn from consideration need not be submitted if the information is not material to the patentability of any claim remaining under consideration in the application. There is no duty to submit information which is not material to the patentability of any existing claim. The duty to disclose all information known to be material to patentability is deemed to be satisfied if all information known to be material to patentability of any claim issued in a patent was cited by the Office or submitted to the Office in the manner prescribed by §§1.97(b)-(d) and 1.98. However, no patent will be granted on an application in connection with which fraud on the Office was practiced or attempted or the duty of disclosure was violated through bad faith or intentional misconduct. The Office encourages applicants to carefully examine:

- (1) Prior art cited in search reports of a foreign patent office in a counterpart application, and
  - (2) The closest information over which individuals associated with the filing or prosecution of a patent application believe any pending claim patentably defines, to make sure that any material information contained therein is disclosed to the Office.
- (b) Under this section, information is material to patentability when it is not cumulative to information already of record or being made or record in the application, and
- (1) It establishes, by itself or in combination with other information, a prima facie case of unpatentability of a claim; or
  - (2) It refutes, or is inconsistent with, a position the applicant takes in:
    - (i) Opposing an argument of unpatentability relied on by the Office, or
    - (ii) Asserting an argument of patentability.

A prima facie case of unpatentability is established when the information compels a conclusion that a claim is unpatentable under the preponderance of evidence, burden-of-proof standard, giving each term in the claim its broadest reasonable construction consistent with the specification, and before any consideration is given to evidence which may be submitted in an attempt to establish a contrary conclusion of patentability.

(c) Individuals associated with the filing or prosecution of a patent application within the meaning of this section are:

- (1) Each inventor named in the application;
  - (2) Each attorney or agent who prepares or prosecutes the application; and
  - (3) Every other person who is substantively involved in the preparation or prosecution of the application and who is associated with the inventor, with the assignee or with anyone to whom there is an obligation to assign the application.
- (d) Individuals other than the attorney, agent or inventor may comply with this section by disclosing information to the attorney, agent, or inventor.